Theory and Evidence on the Finance-Growth Relationship: The Virtuous and Unvirtuous Cycles

Eliana Lauretta and Sajid Chaudhry and Andy Mullineux

University of Birmingham, University of Birmingham, University of Birmingham

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Eliana Lauretta,[*] Sajid M. Chaudhry,[†] Andrew W. Mullineux[‡]

Abstract

Since the 1980s, financial crises have tended to reoccur with increasing frequency and growing intensity. They are endogenously generated by the established OTD (Originate-To-Distribute) model within the new finance-growth paradigm. Good finance fosters the correct allocation of financial resources, the fair redistribution of wealth and positive economic growth (the virtuous cycle), whereas bad finance captures part of the created wealth and, thanks to a highly technologically advanced financial system with the ability to create money *ex nihilo*, over time it drags the economy down to recession or negative growth, destroying wealth and consequentially social welfare (the unvirtuous cycle). Therefore, structural factors are at the foundation of the persistence of instability and thus of what we define as the *unvirtuous cycle*, which can generate what we label the *wealth trap*. A VUC index has been developed by us to capture the status quo of the finance-growth relationship. A cross country analysis for the US, UK and Euro area economies has been made in order to verify the validity of the index. A core variable is identified: the *degree of financial innovation*. This is an endogenous variable within the endogenous money/credit creation process; its identification is of crucial importance, as it is the key to full understanding of the finance-growth relationship and is the element of originality in this field of studies. The VUC index for all countries shows clearly the exponential effect of the *degree of financial innovation* over time. It is important for scholars and policymakers to understand the mechanism underpinning the finance-growth relationship and that it is their responsibility to return the economic system to what we will call the *virtuous cycle*.

JEL codes: (E44, E32, E50, E51, G01, O33)

Keywords: Finance, Growth, Business Cycle, Financial Innovation, Regulatory Dialectic, Financial Power.

[*] Dr Eliana Lauretta, Post-Doctoral International Research Fellow, Birmingham Business School, Department of Finance, University of Birmingham, UK, e.lauretta@bham.ac.uk .
[†] Dr Sajid Mukhtar Chaudhry, Lecturer in Finance, Birmingham Business School, Department of Finance, University of Birmingham, UK, s.m.chaudhry@bham.ac.uk .
[‡] Prof. Andrew William Mullineux, Birmingham Business School, Department of Finance, University of Birmingham, UK, a.w.mullineux@bham.ac.uk .

1 Introduction

Why is it so important to understand the link between finance and growth? Studies of the 2007-09 credit crisis and the resulting recession have revealed the inadequacy of the predominant theoretical frameworks and their failure to propose adequate policy solutions (Ryan-Collins et al., 2011; Bezemer, 2012). The characteristics of this kind of crisis are the evolution from a typical financial crisis to a real economic one. Usually, political economy analysis has a monetarist or neoclassical footprint, such as that used in the European context. However, the recent chain of events questions the validity and efficacy of this standard approach. The notion of the "neutrality of finance" (Modigliani and Miller, 1958) or the "independence of the money making process from the credit making process" (underlying the mainstream theory of finance) (Hayek, 1931, pp. 27-28) misrepresents economic dynamics. It constrains the identification of the problem and its resolution. The presence of "bank money" in the economy and in a financial system (not only constituted by banks) characterized by financial innovation and speculation fundamentally changes the nature of credit creation.

Financial instability in the economy seems to depend on the financial structure. Minsky (1982) himself defines the role of lenders as "endogenously destabilizing". It is crucial to investigate the reasons for the endogenous creation of financial crises. Therefore, the underpinning emerging questions are: "How do the economic and the financial systems interact to affect economic growth? Is there any role played by financial innovation in affecting endogenous money/credit creation?" and also, "Is there a profound difference between sociological[1] and technological[2] definitions of the financial system?" Technological development does not seem to have been combined with highly-civilized behaviour. The financial sector appears to have the power through financial innovation to spread "self-seeking" behaviour throughout the economic system, distorting the original functions for which financial institutions were established. After the 2007-09 crisis, understanding of the causes of "why" the presence in the economic system of the technologically advanced (but not necessarily sociologically

developed) financial system could provoke the dynamics of economic expansion or depression becomes of primary importance. Therefore, the analysis that scholars and decision makers need to take into account takes place in two directions: the finance-growth and growth-finance relationships. The literature is usually more focused on the growth-finance relationship (e.g. Robinson, 1952; Lucas, 1988; Greenwood and Jovanovic, 1990, Greenwood and Smith, 1997)[3] rather than the finance-growth one (e.g. Levine, 2003, 2005; Bezemer, 2012; Beck, 2011; Zingales, 2015).[4] As the financial crisis has clearly shown us, the finance-growth channel seems to be the new established paradigm. What we need today is accurate and full knowledge of both sides of this relationship, supported by appropriate theories and subsequent data-based evidence to enable policymakers to apply adequate regulations. Modelling the real phenomena means that solid assumptions need to be made and model architecture built upon them. We have today many quantitative models which are mathematically or statistically based, but with increasing levels of complexity they are often divorced from reality. This is why it is important that a theoretical (more narrative) and quantitative approach should be developed at the same speed.

This study aims to sketch a theoretical backbone as a sound foundation for the development of an appropriate theory of the finance-growth relationship, as a base for the future development of economics models able to represent this new paradigm.

1.1 Brief Literature Review

Economists have adopted different frameworks for the analysis of the relationship between economic growth, finance and innovation. An important debate emerged during the 1980s and 1990s between Evolutionary Theory (ET) and the more neoclassically inspired New Growth Theory (NGT). New Growth Theory (NGT) and Evolutionary Theory (ET) have a "common denominator" in Schumpeter's studies. Therefore, we might look at these two theories as sons of the same father. They present some important differences and similarities. Broadly speaking,

on one hand NGT has developed a more impressive mathematical toolkit, but presents artefact elements with no clear link to reality (aggregate analysis). In particular, the positive aspect of its contribution is that it takes into serious consideration the issues of allocation of resources and, in particular, of financial resources. On the other hand, ET has largely neglected the issues related to the allocation of financial resources and the relationship between finance and innovation; it mainly takes a static approach that suffers from the lack of a solid theoretical pillar (as a consequence, evidence is often ambiguous). However, in ET innovation analysis the assumptions and variables considered are linked more closely with reality and the investigation moves towards a co-evolution at micro and macro levels with heterogeneous agents. In general, the two approaches differ less in their views of the importance of innovation and technology for growth. However, with regard to other elements, in particular the role of the financial system in stimulating the innovation process, they differ more. This because the NGTs are inspired by Schumpeter's studies made in the first part of his academic career. Conversely, the ETs have largely neglected the relationship between finance and innovation, as they are inspired by Schumpeter's thoughts dating from the second phase of his studies, when he himself neglected the important role of the financial system (Verspagen, 2004).

Making a brief review of the literature starting from Joseph Schumpeter's (Schumpeter, 1934, 1939) studies, we notice how he particularly considered the role of credit. In his studies during the early phase of his university career, he put the financial system at the centre of the economic system. He argues that innovation is founded on the creation of credit and thus the importance of the financial system is crucial to facilitate the waves of innovation and, in turn, to stimulate growth. Unfortunately, he revises his analysis of finance in the second part of his university career, giving more emphasis to internal funding over the external, and downplaying the role of credit creation and the bank system in facilitating innovation and economic development. Nonetheless, he was not the only one who believed that money was endogenous (for example Wicksell, 1898 (ed. 1965) or Robertson, 1928) and maybe he was not the first to introduce the linked concepts of swarms and clusters of innovations and endogenous money creation. Keynes'

(Keynes, 1936) ideas, like those of Schumpeter (1934), contrast with the mainstream theory; he claims that the diffusion of "fiat money" and other financial aggregates are non-neutral and cause radical structural transformations in the economic system. "Bank/credit money" modifies the economy from a pure exchange system in which the endowment of resources are known and the main problem is its trading efficiency, into a production system, in which the relevant variable is the time dimension (Bertocco, 2007). However, Keynes and Schumpeter had different approaches to justifying the non-neutrality concept in their own monetary approaches. In his General Theory Keynes (1936) focusses his attention on the money market rather than the credit market, and gives prominence to the stock of value function of money. In Schumpeter's analysis the credit market plays a central role and it gives importance to the means of payment function of money.

An interesting contribution was made by George Shackle, who was able to assimilate the core of Keynes's ideas about the prominent role of investment as the engine of the macroeconomy and the originator of the business cycle and growth[5]. Shackle believed that time, uncertainty (in terms of degree of potential surprise), and expectations play a significant role in shaping the agents' choices (Shackle, 1968). These three elements encapsulate his contributions to economics. He disputed the maximization of expected utility as a criterion for choice under uncertainty. The nature of the economic phenomena provided by the use of money, where money in its full nature plays an essential role, allows simultaneous decisions to affect each other, and imagination (in terms of invention and not of innovation) to play the role of a means of speculation. The presence of money also implies the presence of uncertainty; in particular, if the possibility of exchanging money now for promises of money to be paid later is introduced. So-called "bank money" becomes a means of deferring decisions; decisions which are deferred cannot be anticipated and will affect future situations and events. Therefore, for Shackle, the monetary economy is inherently unpredictable. In fact, he argued that a "monetary economy is driven by expectations and that expectations, although bounded by what is considered as possible (non empty decision), cannot be predicted" (Shackle, 1967). In addition, Shackle

provided some valuable insights (encapsulating the essence of the Keynesian theory of the rate of interest) into the determination of this rate and its role in the macroeconomy (Chapter III of his book "Expectations, Investment, and Income")[6]. Unfortunately, he does not develop a deeper analysis of the impact of the financial system on economic growth in his "real" business cycles, because although he accepts the endogenous nature of money, and points out the non-inert role of speculation, he still considers that the rate of interest and the banking system play passive roles.

It seems clear that a new perspective on the financial role in defining the growth path needs to be developed by filling the gaps in New Growth Theory (NGT) (Aghion and Howitt, 1998) and Evolutionary Theory (ET) (Nelson and Winter, 1982)[7], giving in this way concrete realization to the insights of scholars such as Schumpeter, Keynes and Shackle about the money/credit creation role. Another important gap in the literature regards the integration between qualitative and quantitative analyses. Many works that attempt to find evidence for the existence of the relationship between finance and growth and vice versa (in particular in the financial economics field) is simply empirical research focused on statistical analysis which is data-driven, and on country differences (in large-scale cross-country regression). These analyses have not kept pace with theoretical developments and the evidence that does exist is often ambiguous.

The remainder of the paper is organized as follows. Section 2 and 3 explain the VUC (virtuous-unvirtuous cycle) theoretical dynamics and present the main assumptions as stylized facts according to which the economy switches from a virtuous to an anticompetitive unvirtuous cycle and introduces the concept of the *wealth trap*.[8] Section 4 introduces the developed VUC index, which clearly shows whether the business cycle is going in the direction of the virtuous or unvirtuous cycle. An across country analysis of the US, UK and EU economies is made in order to verify the validity of the index. Section 5 provides policy implications and concluding remarks on how and why a virtuous cycle should be restored and maintained. Outlines of future developments of the research are provided.

2 Virtuous - Unvirtuous Cycles (VUC) Theory

The new challenge in the field of economics is to understand the role of the financial system in the reverse relationship (finance-growth, rather than growth-finance). The financial system distributes purchasing power, reduces information asymmetries, improves resource allocation and reduces transaction costs. The rapid technological development of the financial system has opened a heated discussion about the relationship between finance, innovation and growth; in particular, with regard to its ability to gain greater influence over the real sector of the economy, developing the capacity to manipulate economic policy and economic chances/outcomes (financial/political power) by the creation mechanism of endogenous "bank money" (so called financialization; see Palley (2007) for a good introduction to financialization) . Unfortunately, some economists do not believe that the investigation of the finance-growth relationship is important because they simply consider how economic growth affects financial system development through growth-promoting intermediaries, including the stock markets (see for example, Greenwood and Jovanovic, 1990; Greenwood and Smith, 1997) and they remain sceptical about a possible crucial role of the financial sector in the definition of the economic growth path. However, an increasing awareness about the more and more complex dynamics of the financial system's endogenous money creation ability seems to point out that there is a reverse relationship between growth and finance that cannot be ignored. It is possible to find this view in Levine (1997, p. 703), who asserts generically that: "... economic growth provides the means for the formation of growth-promoting financial intermediaries, while the formation of financial intermediaries accelerates growth by enhancing the allocation of capital."

The new perspective seems to entail a new *greedy* economic status[9], where the financial state determines the growth path. With the last financial crisis this aspect emerged clearly, highlighting that the mainstream growth-finance relationship has been inverted. Brandl's (Brandl, 1998) working paper gives us an interesting insight that leads our analysis. In Brandl's

perspective there seems to exist a financial institution-economic growth relationship, which is applied to countries with low incomes. The core of his idea is the link between the concept of the poverty trap and financial institution development. He explains that in low-income areas, where there are absences or weaknesses in the economic systems of financial institutions, people can only save money "under the mattress" and entrepreneurs cannot easily borrow funds. Thus, an economy with a lack of financial institutions cannot optimally attract savings and for this reason will suffer from low saving rates. This will lead to a low level of investment and the economic system will have slow or no economic growth. Consequently, this cycle delays financial institution development. In other words, economic growth increases proportionally to financial institution growth and different strands of the literature, in particular the financial literature, consider this relationship to be true. Converse to the Brandl hypothesis, what happens if an economic system has a *greed*y financial system with a high level of savings invested? (which is the case of high income countries). Does the presence of *greedy* institutions reflect a highly-civilized financial system? And if the two "sides of the same coin" do not coincide, can the economy generate a sort of *wealth trap*?[10] This could be possible. The label *greedy* here is used to underline the real status of the financial system today, which is characterized by financial trading activity which has strategic self-gain motivation. Currently, the financial market is characterized by complexity; it is a liquid market, where supply and demand match automatically. The financial intermediary plays the role of insuring liquidity and earns money by managing the flow of investments. The technological revolution which started in the 1970s/80s is the basis of this development. In fact, the "IT network economy" has become the place where it is possible to trade longer, in smaller volumes, and faster. Consequently, the key difference between a good (virtuous) and a bad (unvirtuous) financial system is whether it dampens (through diversification and insurance models) or amplifies (through securitization and speculation) the asset price inflations, bubbles and ultimately crises with related balance sheet recessions.

From here it is possible to identify the main elements which are the basis of what we have labelled VUC Theory. As the scheme (see figure 1) shows, we can identify two possible cycles:

[INSERT FIGURE 1 HERE]

~ **The Virtuous Cycle:** when the economy follows what we called a *virtuous cycle*, the presence of a *highly technological level* of financial institutions operates beneficially, with a high level of savings put into productive use in the economic system, which spurs a highly productive level of investment and funding for innovation projects. A high-growth level results. In this case, growth leads financial system development and efficiency (the growth-finance relationship). In this cycle we might observe the passage from a period of *prudential attitude*, when debt use is careful, to a period of prosperity, when the debt exposure of all the agents operating in the economic system grows rapidly (according to Minsky, 1986).

~ **The Unvirtuous Cycle:** the alternative perspective seems to entail what we call a *unvirtuous cycle*, in which the financial state determines and leads the growth path. At a certain point, the *highly technologically advanced* financial system starts to abuse its monetary creation power,[11] turning the original social function for which the financial institutions were developed into a self-gain one. The financial system, thanks to the presence of sophisticated financial innovation tools, becomes able to capture financial resources from the business cycle. These financial resources are not allocated to the productive sector but are diverted into speculative channels for self-seeking profit interests. As a result, the growth-finance relationship is inverted into the finance-growth one. This strengthens the possibility that increasingly aggressive "boom and bust cycles" are created over time, with wider gaps with respect to potential GDP and a reduction in the length of time between the occurrence of one boom-bust and another.[12] The increasing level of volatility created in the business cycle makes the economy become more fragile, raising the possibility of turning easily from simple financial/real shock to severe economic crises. As a consequence, business and

innovation investments slow down, and the level of growth declines until, in the worst case scenario, there is recession and negative growth (as was observed after the 2007-2009 financial crisis). Regulatory loopholes emerge and current regulation becomes inadequate. Thus, crisis forces re-regulation and a switch to a virtuous cycle for a certain period. However, when the financial capitalists exert new pressures for liberalization (as the time since the last crisis increases) the virtuous cycle gradually tends to turn bad again as the political influence of financial capitalists and regulation laxity increases, until the next crisis erupts. Hence, more regulatory tightening will be applied, and so on.

2.1 Financial Market/Political Power Concentration

The degree of market/political power concentration in the hands of the modern financial system is at the core of the switching mechanism between virtuous and unvirtuous cycles. Over time, due to financialization, the financial oligarchy has built up a strong influence over the political system and its elites (Calomiris and Haber, 2014; Johnson and Kwak, 2010) activating a regulatory capture and promoting liberalization (deregulation). A "regulatory dialectic" (Kane, 1977) underpins the passage from one cycle to another. The acceleration of technological and market changes within the financial system has transformed the speed of the regulatory adaptation of the decision-makers and financial operators (Kane, 1983). It has also increased the gap between them, enabling the financial operators to respond more quickly to regulatory changes, finding new ways to circumvent regulatory constraints, while decision-makers respond more slowly to emerging problems. The decision-makers' delayed responses leave space for the financial system to build up its market/political power. This highlights how important it is for decision-makers to keep pace with increasing environmental and structural changes. When we are in a unvirtuous cycle the regulatory adaptation gap[13] is so large that the financial powers have the chance to become stronger and whenever the decision-makers make

a regulatory adjustment the financial-institution pressures upon the political powers change accordingly.

The main new proposition is that an economy in which financial institutions are *greedy* currently exists and there is the possibility of a switch from a *virtuous cycle* to an anticompetitive *unvirtuous cycle*. If the increasing political power of the financial markets (an externality of the evolution of the financial system) is not correctly managed (and thus it is possible to speak of the increasing "political power" of the financial system), the relationship will run in the opposite direction to the *virtuous cycle*, activating a wealth destroying cycle.

2.2 The Monopolistic Financial Oligarchy Leads to the Wealth Trap

The financial markets can implement speculative activities. The set of financial markets in the current system of capitalism tends to focus on different and specific activities at different times, creating a "speculative bubble". The engineering ability to create new financial services and products, combined with deregulation and bigger financial institutions (following the motto "too-big-to-fail") operating in the market, has fostered the development of the financial industry's oligarchic and monopolistic power over the economy and politics. At a certain point, the excessive accumulation of debt in the economy makes the system break down (because someone is not able to repay his obligations), triggering a "domino effect". Temporal shocks and financial crisis occur in the economy, which can transform a "virtual" crisis into a real one. Today we are in a global macroeconomic system. Therefore, if a crisis starts within the global financial system, it can contaminate the entire global macroeconomic system. The main consequences of a crisis status are: 1) the bank system in particular and the financial system in general cut funding; 2) a credit crunch (also known as credit squeeze or credit crisis) and falling confidence occur; 3) firms and households cannot easily obtain loans; 4) firms cannot make

investments for ordinary productivity or to finance innovation projects; and 5) as a result, a slowdown of economic growth or, in the worst case, a move towards recession, with an important loss of wealth in terms of growth takes place.

Basically, the *unvirtuous cycle* generates what we have labelled as the *wealth trap*. This latter encapsulates the "political/market power" concept of the technologically advanced financial system which manipulates the growth path. If the technologically advanced financial system pursues its speculative interests, it captures the wealth created in the cycle and incorrectly allocates capital. The modern financial architecture has been able to create the illusion of fuelling productivity and innovation projects (increasing the level of GDP of the developed countries), but on the other hand it has allocated financial resources to specific trading activities related to the productive sectors, generating asset price inflation and bubbles that can turn into a crisis.[14] The *wealth trap* differs from the short term Keynesian "liquid trap", which is a possible consequence of the *wealth trap*. The *wealth trap* generated by the unvirtuous cycle increases the "Financial System Default Risk" over time. As a consequence, a liquidity and ensuing solvency crisis in the financial system can occur. Moreover, there is the risk of falling into a "liquidity trap", in which any monetary stimulus has no effect on interest rates or output. Thus, the real economy would suffer from the wealth created in the liquid trap and slowly slide into negative growth.

2.3 The Core Role of Financial Innovation

The advanced financial system facilitates financial product differentiation (through financial engineering), producing deep market segmentation. The financial markets continue to produce a multitude of new products (derivatives, alternative risk transfer products, exchange traded

funds, and variants of tax-deductible equity). Following the bad path (unvirtuous cycle), the financial system has today put in place a discriminating monopoly in which market power and political power are tightly linked. It uses this monopolistic position and its market/political power to increase self-gain and maximize economic rent. Therefore, it captures consumer surplus.

Nevertheless, how has the financial system been able to increase its market/political power? Financial innovation plays a central role, and innovation puts inventions into practice. Therefore, this leads to the implementation of business decisions about the use of a new invention that can reduce marginal costs (also coming from regulation) and maximise profits. These decisions could be good or bad if they are socially oriented or not. Therefore, in finance good financial innovation improves risk management and reduces transaction costs. In contrast, bad financial innovation facilitates market segmentation and rent seeking speculators. Through a kind of accelerator effect, positive economic rent opportunities created by bad financial innovation, and ongoing segmentation, increase information asymmetries. This in turn increases the possibility of default and the likelihood that a financial crisis will become an economic crisis. In addition, when private interest "captures" the public interest, it is highly likely that speculative finance will build up, as predicted by Minsky (1982). The established new economic model qualitatively described in this section seems to have political economy dynamics with a non-linearity, by which the system can flip from good to bad cyclical equilibrium. There is a sort of long Minsky Cycle punctuated by major crises, with progressively fewer virtuous shorter term cycles superimposed.

3 Foundations of VUC Theory

The main idea supporting the integration of the global financial system was to build financial stability, which can contribute to the stability and development of the economic system. However, as the 2007-2009 financial crisis has shown, a collapse in one part of the global economic system has a pandemic effect upon the entire economy. As Stiglitz (2010) claims,

"diversification and contagion are different sides of the same coin." The will to diversify risk by complex financial integration of the economy is accompanied by the risk of associated externalities, in particular when the presence of an advanced financial system is, in sociological terms, *greedy*. This can increase and concentrate the market/political power of the financial markets (creating a monopoly) and this power concentration could be manipulated to satisfy private interests. What seems to emerge is that risk increases with integration. However, we cannot avoid integration in a new designed and globalized economic system. For this reason, to restore and then to preserve the virtuous path of the economic cycle, given the new historical context of the economic system as a whole, has become a top priority. Therefore, it is crucial to draw the main leading assumptions underlying VUC theory in a more formal way. The following stylized facts fulfil this purpose:

~ **Determination of real GDP:** The variation of the total output *Y* is a function of financial power *FP*, capital input *K*, labour input *L*, and innovation *I*.

$$Y = f(FP, K, L, I) \qquad (1)$$

~ **Financial Power Definition:** The financial system holds financial power, which can affect the total output. Financial power is a function of the leverage ratio *LR*, financial innovation *FI* and the financial institutions' size *SZ*. The *FP* could be defined as a positive (in the virtuous cycle it is a positive externality) or negative (in the unvirtuous cycle it is a negative externality) distortion in terms of GDP. It depends on how financial power is managed by the financial system; if it is oriented to financing the productivity of the economic system (socially oriented) or if it is mostly oriented to self-seeking speculative and profit interests (private interest orientation).

$$FP = f(LR, SZ, FI) \qquad (2)$$

Specifying the variables, *LR* is the amount of capital divided by total assets. It is the variable that implements financial institution profits. *FI* represents the "financial

innovation industry" of the financial sector (financial R&D). It embodies the concept of *degree of financial innovation*, which is the measure of the level of development of the financial tools thanks the R&D in the financial sector, and it represents the degree of development of the technologically advanced financial system. *SZ* is the size of the financial institutions. A good measure of a financial institution's size can be market shares to GDP. This latter variable is important because it is closely related to the *degree of financial innovation*. In fact, financial innovation activity is influenced by banks' investments and size. The growth of the financial industry has long been considered a positive development by academics and regulators and has been facilitated by policies. The belief that the presence of a large (too-big-to-fail) financial system is useful for the economy no longer seems to be so true after the financial crisis of 2007-9. An interesting discussion has arisen about the excessive size of the financial sector in advanced countries, regarding the possibility of applying regulatory restriction forms (Turner, 2010). Privatistic motivations might have supported the emergence of the too-big-to- fail[15] policy model. For the same privatistic motivations the financial sector was, and still is, excessively protected. The too-big-to-fail institutions expect that government policies will protect them in a critical scenario from all losses that might occur. A more permissive policy has led to the easier promotion of the development of financial innovation tools, facilitating access to new financial instruments and products. This has contributed to a shift from the original financial system model (OTH - Originate-To-Hold)[16] to the newly established OTD (Originate-To-Distribute) model.[17] Therefore, the agents operating in the financial system (not only banks) collect profits while passing on risk to the next link in the value chain. Thus, the presence of multi-leverage within the financial system (at any chain level) implies cycles of increasing amplitude in real and financial variables. In particular, the financial innovation introduced by the non-bank financial sector has created an acceleration effect of lending and debt that is not possible in the normal credit creation regime by banks (multi-multiplier effect). The oversized financial sector has gradually extended

its scope beyond the traditional bank activity of intermediation, towards non-intermediation financial activities. As a result, in modern financial systems, the traditional measures of intermediation activities do not reflect reality and the actual gap concerns the effect of financial sector size on growth and volatility.[18] However, we claim that financial regulations in favour of the financial system without the technologically advanced financial transformation would not have instigated any change in bank behaviour in terms of creditworthiness conditions (or it would be very partial and not relevant). What has made the difference is financial innovation and the building up in the last two decades of what we call the technologically advanced financial sector (see Figure 2).

[INSERT FIGURE 2 HERE]

~ **The correlation between Financial System Default Risk and Financial Power:** The high financial system default risk state *FSDR* created by the distortion of financial power, in particular through the accumulation of bad debts *BD*, affects the growth path and triggers the unvirtuous cycle. As a result, the growth-finance relationship is inverted:

$$\varepsilon = \frac{\Delta FSDR}{\Delta FP} = Volatility \qquad (3)$$

with

$$FSDR = f(BD) \qquad (4)$$

~ **The Unvirtuous Cycle - Crisis Generator:** The common idea, according to the mainstream point of view, is that the financial system (usually a representative commercial bank) acts as a simple platform, taking money from savers (transformation of short-term savings) and lending it to borrowers (into long-term lending). Therefore, the function of commercial banks (and financial institutions in general) is important

but not relevant in affecting the economic outcome in any way. This is because when a financial crisis occurs it has been seen as an exogenous shock. This viewpoint is not really consistent with reality, in particular after the introduction of the first revolutionary financial innovation, the electronic payment system at all levels of the financial system. Financial development enables the financial system (constituted not only by commercial banks) to extend the credit process, and ensures that this kind of debt can be used by households and productivity systems as money (Ryan-Collins et al., 2011). Thus, it is undeniable that the financial system as a whole is at the centre of the debt creation and repayment mechanism and consequently it is unavoidable to consider it at the core of the economic system (Minsky, 1982). Endogenous money creation could be seen as a function of the *degree of financial innovation* within the financial system. As defined before, this represents the level of development of financial tools available at a certain time thanks to the presence of R&D in the financial sector and the level of investment spending to finance financial engineering development (as a parameter). However, we need to separate the effect of the financial innovation in itself, which is always positive, from the effect of the *degree of financial innovation*, which could be positive or negative. Broadly speaking, financial innovation represents the set of tools, while the *degree of financial innovation* represents the use of these tools. The latter stands for the financial system's demand for more and more complex and sophisticated ways to circumvent current regulations and to diversify the risk, while generating increasing levels of profits at reduced costs. Thus, we can say that financial innovation *FIN* in itself is simply a function of R&D (Research and Development). However, the *degree of financial innovation DoFIN* is the product of a parameter α representing the level of investment spending channelled to the financial R&D (Research and Development) sector for the creation of advanced and abstruse financial products and services.

$$FIN = f(R\&D) \qquad (5)$$

$$DoFIN = \alpha(R\&D) \qquad (6)$$

with

$$R\&D = \left(\eta R_A^{\phi}\right) A \qquad (7)$$

Where ηR_A^{ϕ} is the human capital involved in R&D with ϕ = 1, while A is the stock of knowledge that the investment bank has and η is a productivity parameter of human capital.

R&D in the financial sector can be seen as the experimental activity of innovation and imitation to develop a stock of knowledge to improve or renovate the existing mathematically complex tools and financial packaging strategies to create new profitable and speculative financial products[19].

However, what is the relationship between endogenous bank money/credit creation and the *degree of financial innovation*? It is possible to identify the connector in this relationship in the securitization process. Through this process, financial agents can act on their balance sheets, bringing off-balance a fraction of their debts (usually the risky ones) to be transformed by the financial innovation tools into new, complex and negotiable financial products. Speculative financial innovation (as opposed to good financial innovation), driven by the market and political power concentration in the hands of the financial system, gives to the actors operating in the financial system the possibility to expand the money creation mechanism.[20] The expansion of the money/credit creation ability by the financial system can increase endogenously the level of financial instability and financial system default risk, in particular if the money/credit generated is not allocated to productive purposes. As a result, what we label the *unvirtuous cycle crisis generator*, which is endogenous to the finance-led economic system, is activated.

$$Unvirtuous\ Cycle\ Crisis\ Generator = e^{\varepsilon} \qquad (8)$$

Proceeding a little further in the analysis to understand better the interconnections theoretically, for the sake of simplicity we can take into consideration the structure of the balance sheet of commercial banks.[21] Any variation (expansion or contraction) of the endogenous creation of bank money *BMC*, represented as an exponential function, is given by a consequential variation of the securitization ratio *SR* calculated by the ratio between *Tot Loans* and *Tot Deposits*.

$$BMC = \Delta e^{\delta \frac{Tot\ Loans}{Tot\ Deposits}} \qquad (9)$$

with

$$\delta = \frac{Loans\ off-balance}{Tot\ Loans} = SR \qquad (10)$$

For the sake of clarity, it is important to highlight that the securitization ratio is, in turn, a function of the previously mentioned *degree of financial innovation*.

$$SR = f(DoFIN) \qquad (11)$$

To summarize, a practical example can explain this last point better. Function 11 connects the creation of endogenous bank money and the financial innovation represented by the securitization ratio. Supposing a bank balance sheet with total loans of 320 as assets and total deposits of 272 as liabilities, and that we apply different levels of the securitization ratio (0.10, 0.15, 0.20, 0.25, 0.30, 0.35 and 0.40) over time (see the exercise plotted in figure 3), intuitively, the increasing or decreasing levels of the securitization ratio over time make the curve steeper or flatter. It is important to stress the concept that what affects the securitization ratio is the *degree of financial innovation* operating in the system at a certain time. The higher the demand for advanced financial tools for speculative purposes, the higher the level of *degree of financial innovation*. As a consequence, the financial agents resort more to the securitization mechanism.

This means increasing the level of financial instability and consequently financial system default risk (*FSDR*).

[INSERT FIGURE 3 HERE]

Eventually, the exponential function governs the interrelation between endogenous bank money creation, securitization and *degree of financial innovation*. In terms of the balance sheet approach, when the inclination of the curve is too high (bubbles) this means that the gap between assets and liabilities becomes unsustainable. The exponential direction taken cannot continue to infinity and naturally the system creates its own upper limit (explosion of the bubble and crisis propagation within the system). Therefore, both financial and economic systems need to adjust themselves and crisis becomes the natural way to rebalance the asset-liabilities accounting level of the entire economic system, bringing it back to a certain sustainable level. According to Koo (2014) the "balance-sheet recession[22]" is caused by the transmission mechanism that governs the financial and economic system balance-sheet adjustments. It is also important from which side of the economy the balance-sheet adjustment of the economy is coming. In fact, it is different in terms of the size of the crisis as to whether it is triggered by the real sector or by the financial sector. The shocks produced from the productive sector do not have the same origins and impact on the global economy, as is the case of the shocks produced by the financial sector, such as the 2007-2009 systemic financial system default and the following economic recession.

4 The VUC Index

Currently, a wide discussion around the world is focusing its attention on macroprudential tools as early warning indicators (EWIs)[23] (Galati and Moessner, 2013, Babecký et al., 2013) instead of developing a more needed concrete debate on structural policy.

The main problem with this kind of indicator, apart from the difficulties in estimating precisely the costs and the benefits of the tools, is that it is still used for forecasting purposes. What is

really needed is a pioneering and innovative model to identify and track those time-varying variables which are the causes of systemic risk and financial-economic instability. An optimal forecasting model would entail a full knowledge of the variables present in a complex and interconnected system (such as the financial and economic systems) and the possibility of accessing the information related to the underling decision problems. This implies the existence of a world led by perfect information (no asymmetries) and rational expectations. However, these empirical models are mainly built around mainstream theory, while it is widely recognised by the majority of scholars that its assumptions and mathematical stylization of the economic and financial dynamics are unrelated with reality. What makes this model so attractive is its ability to provide policy scenarios in the mid to long term, given the quantitative validation and robustness of the results obtainable. However, according to the 'black swan theory' (or theory of black swan events - Taleb, 2010) some events (such us the last 2007-2009 financial crisis) and their underlying variables are unexpected because, given that they were not observed before[24], they are unknown and unpredictable. Moreover, the forecasting models can be useful to identify the well-known variables for which we can gather perfect information[25] but are unable to capture the new emerging variables (black swans) given the structural changes occurring within the economic and financial system.

In the last two to three decades we have witnessed a volatile acceleration of the changes in the complex relationship between financial and real economic systems. It is important to develop a policy analysis capable of taking pictures of the present stage of the interactions between the two sides of the system over time. It needs to be combined with both historical[26] and institutional analysis[27] to make comparisons between the past and the present stages of the structure of the financial and economic systems. To compare the pictures of the past and the present of the historical economic and financial conditions and the institutional changes which have occurred might give useful (but not perfect) information to identify the emerging changes of the variable. A sort of a monitoring mechanism would help us to isolate in time the new emerging variables which may trigger several effects on the business cycle. For an

understanding of the long-term dynamics we need to monitor the short-term evolution and functioning of both sides of the finance-growth and growth-finance relationship. An alternative policy strategy should be put beside the already existing policy instruments available. This alternative policy should act on the emerging variables, rather than on the trend. Of course, a big effort is required to develop a range of short-term, flexible policy tools able to manage in time the potential risk variables, interactions and interconnections that could boost instability and might increase the risk of boom-and-bust in the business cycle.

The developed VUC (Virtuous-Unvirtuous Cycle) Index would not be treated here as a kind of early warning indicator. However, it can be applied as a base for forecasting analysis whenever needed. It is intended to be a monitoring and informative tool for policymakers who are concerned with the level of vulnerability of the finance-growth relationship. In particular, given the VUC Theory discussed in section 2, the index provides initial strong evidence for the switching from virtuous to unvirtuous cycles and for the complex finance-growth relationship.

The originality of the index is that it incorporates a securitization mechanism. It is therefore able to capture the endogenous role of financial innovation (*degree of financial innovation*) within endogenous money creation.

$$VUC\ index = \frac{\frac{\sum_{b=1}^{N} TC_T}{Eq^b}}{GDP} \qquad (12)$$

TC_T is the percentage of tot credits that each financial agent decides to bring off-balance sheet to be transferred to the securitization process. Eq^b is the total equity value of each financial agent. *GDP* is the Real Gross Domestic Product.

The index could be seen as a transformation of the credit-to-GDP index, which only takes into account the leverage applied at the commercial bank level. In fact, the credit-to-GDP index ignores the multi-leveraging effect that was at the bottom of the last financial crisis. Therefore, the VUC index contains a second order of leverage, representative of the multi-leverage present

in the real financial system. The popular credit-to-GDP index and the new VUC index should be used together as guide for setting effective policies on the emerged variables produced by the reversed relationship between growth and finance. However, in the future the index needs to be extended with an 'emerging variables capturing mechanism' which could make the index most powerful and effective for macroprudential policy purposes.

4.1 Testing the VUC Index: A cross-country analysis

In this section, we discuss the construction of the VUC (Virtuous-Unvirtuous Cycle) Index to verify its validity in relation to VUC theory and the related phenomena we described in sections 2 and 3. The developed index provides the first empirical evidence of the switching from virtuous to unvirtuous cycles and of the complex finance-growth relationship. The index is strictly correlated to the endogenous mechanism of money creation by the financial system. Furthermore, we argue that a simple index is able to show the type of cycle we are in. It is important to note that our index does not have any predictability power (and it does not intend to have), but perhaps it can be used as an early warning indicator. Neither does it explain the exact time of the unvirtuous cycle. However, the index shows a relevant observatory power capturing the actual direction of the business cycle path, and whether it is moving in the direction of the unvirtuous or virtuous cycle. This latter could have some interesting policy implications. For the purpose of comparison and to make our analysis more robust, we conduct our analysis in the US, UK and Euro area.

As theoretically described before, the *degree of financial innovation* is a variable that is able to make the curve steeper or flatter in the evolutionary dynamics between financial innovation tool development and endogenous bank money creation (see figure 3 in subsection 3). The cross-country analysis reveals this mechanism clearly and is able to point out over time when and where the curve starts to become steeper (building a unvirtuous cycle) or flatter (restoring

a virtuous cycle), given the role played by the *multi-leverage mechanism* which triggers increasing levels of unperceived risk of upcoming financial crises.

The key variables of the VUC index are the total credit transferred to the securitization process, bank equity and gross domestic product. Basically, the numerator of the index represents the multi-leverage mechanism, which embodies financial innovation (see section 3). The numerator comprises the trading and credit derivatives. As credit derivatives clearly represent financial innovation, we divide the numerator into trading derivatives and credit derivatives. Trading derivatives include ones such as futures, options and interest rate swaps. Credit derivatives include credit options, credit swaps and credit-linked notes.

The availability of credit transferred to the securitization process data is a major issue, which has constricted us to finding an appropriate proxy that is able to approximate to reality.[28]

In addition, the data are available only from 1992 for the US and 1999 for the UK and the Euro area. The time series available for each country regarding historical derivative development are not very long (and sometimes not very exhaustive), denying us the possibility of studying the dynamics from the 70s or before[29].

For this cross-country analysis we rely on the following data and data sources:

1. For the US
    a. Derivatives: Federal Deposit Insurance Corporation (FDIC);
    b. Equity: Bankscope;
    c. GDP: OECD Statistics;
    d. GDP Growth: Federal Reserve Economic Data (FRED);
    e. Unemployment Rate: Federal Reserve Economic Data (FRED);
    f. Government Deficit Rate: Federal Reserve Economic Data (FRED).

2. For the UK
    a. Derivatives: Bank of England Interactive Database;
    b. Equity: Bankscope;
    c. GDP: OECD Statistics;
    d. GDP Growth: Office of National Statistics (ONS);
    e. Unemployment Rate: Labour Market Statistics (LMS);
    f. Government Deficit Rate: Office of National Statistics (ONS);
3. For the Euro area
    a. Derivatives: ECB Statistical Data Warehouse;
    b. Equity: ECB Statistical Data Warehouse;
    c. GDP: OECD Statistics;
    d. GDP Growth: OECD Statistics;
    e. Unemployment Rate: Statistical Office of the European Commission (Eurostat);
    f. Government Deficit Rate: ECB Statistical Data Warehouse;

The exercise is conducted at three levels:

1. With current values.
2. Applying fixed-based index methodology, fixing the denominator at a certain year.
3. Applying chain-based index methodology, moving the denominator year-by-year.

In particular, recourse to the "Fixed and Chain-based Index" methods has been made in order to isolate the role of financial innovation within the finance-growth relationship from the real variables and to capture the *degree of financial innovation* effect (see section 3).

The analysis is completed with a comparison between outcomes, changing the denominator of the index to GDP growth rate, unemployment rate and government deficit rate in order to make a complete analysis of the financial components relative to the real variables. In the following

subsection we discuss the outcomes of the cross-country analysis and show the plots for each country.

4.2 Analysis of the Outcomes

Figures 4 to 15 show the application of the index to the US (figures 4 to 7), the UK (figures 8 to 11) and the Euro area (figures 12 to 15).

Applying the index of Derivatives/Equity/GDP with current values (all the quantities, derivatives, equity and GDP are current) we can observe that the levels of GDP increase over time. Figure 4 shows the growth of the derivatives as a proportion of equity relative to GDP. The lower three plots in figure 4 represent the trading derivatives as a proportion of equity relative to GDP, whereas the upper three plots represent the credit derivatives as a proportion of equity relative to GDP.[30]

One major difference between the trading derivatives and the credit derivatives is that the curve of the trading ones starts to enter a unvirtuous cycle from 2012; however, the credit derivative curve continues to follow a virtuous cycle. This phenomenon is particular to the US, as we do not observe this pattern in the UK. Both the trading and credit derivatives are still in the virtuous cycle in the UK. It may be pertinent to mention here again the limitation that we could not find data disaggregated into trading and credit derivatives for the Euro area. The financial derivatives as a proportion of equity relative to GDP also follow a pattern similar to the UK, where the index shows a decreasing trend after 2012 while the Euro area continues to follow a virtuous cycle (see Figure 8 for the UK and Figure 12 for the Euro area).

Figure 4 also shows the plots of the fixed-based and the chain-based indices.[31] For the fixed-based index methodology, the numbers of derivatives and equities are current; however, the GDP quantities are fixed at the base period. It shows the growth of the derivatives as a

proportion of equity relative to the fixed quantities of GDP. Since the base is fixed, the plots only show the growth of the derivatives as a proportion of equity. For the chain-based index, the base changes year-by-year (i.e., GDP is the previous year's GDP). The plots of these are very similar to when we use the current year's GDP levels, because the difference between the current year's GDP and previous year's is not very big.

We substitute the denominator with GDP growth rate, unemployment rate and government deficit rate in order to observe how our 'innovation' proxy behaves relative to different macroeconomic indicators. As we have seen, the increase in both the trading derivatives and the credit derivatives is huge; however, the increase in the credit derivatives is exponential. We observe a slowing down of the US economy after the 2001 dot.com bubble in the form of a decrease in GDP growth, an increase in unemployment and an increase in government deficit from the three left hand side plots of trading derivatives, apart from the fixed-based index, in figures 5, 6 and 7. We do not see this impact in credit derivatives because of their infancy stage. We nevertheless observe a fall in all our selected macroeconomic indicators in the 2008 global financial crisis.

The behaviour of plots with current quantities and the chain-based index with bases of unemployment and GDP growth are quite similar for the US, UK and the Euro area and they follow almost the same trend we observe when we use GDP as a base (see Figures 5 and 6 for the US, 9 and 10 for the UK and 13 and 14 for the Euro area).

Another interesting observation is that the plots for the "Fixed-based Index" for almost all the bases (such as GDP, GDP growth, unemployment and budget deficit) show similar trends because of the fixed base, and the plots show the growth of the derivatives as a proportion of equity.

The plots for Derivatives/Equity/Budget Deficit for the US and Euro area are fairly similar, but different from the UK because the UK Derivatives/Equity/Budget Deficit plot shows a similar trend when we use other bases (see Figure 7 for the US, 11 for the UK and 15 for the Euro

area). One interpretation could be that there was little use of derivatives in the UK until 2005/2006 and it did not have any impact on the government budgetary balances. However, when the use of derivatives exploded in 2005/2006, it ultimately affected the government budgetary balances.

For the US and Euro area, the use of derivatives impacts the government budgetary balances with some lag. We observe a huge increase in derivatives as a proportion of equity in the US in the mid to late 90s and then that the impact of this is a fall in the government budgetary balances from 1998 to 2001. Subsequently, there is another increase in the use of derivatives and we observe its effects in the form of a fall in government budgetary balances in 2007 and 2008. This trend is observed in the chained index and with the current quantities as a base.

It is interesting to observe the effect for the Euro area of the 2001 dot.com bubble and 2007-08 Global Financial Crisis (GFC) in the form of a huge increase in derivatives as a proportion of equity (see Figure 15).

Finally, the plots of derivatives as a proportion of equity with GDP growth as a base also give interesting insights. They show that initially the impact of the increase in derivatives on GDP growth was not huge. Derivatives as a proportion of equity fell sharply relative to the decrease in GDP growth. However, GDP growth remained low for some period of time, meaning that the impact of the increase in derivatives led the cycle to become unvirtuous (see Figure 5 for the US, 9 for the UK and 13 for the Euro area). This phenomenon is quite clear for all the regions under study.

[INSERT FIGURE 4 TO 15 HERE]

4.3 Discussion of the outcomes

The VUC index for all countries highlights the exponential effect of the *degree of financial innovation* at different time steps. However, the development of the finance-growth dynamics is different for each country. The plots show clearly that the US was the first reckless economy, already starting to build up a unvirtuous cycle from 1992 (and probably before this). The UK and the Euro area, imitating the US in its highly speculative behaviour, took a more moderate position, operating at a lower multi-leverage level. In particular, after 2000 the Euro area continuously developed its unvirtuous cycle (this can clearly be seen if the data and plotting from 1999 to 2009 is filtered), while the UK tried to restore a virtuous cycle between 2002 and 2004, but then fell again into a unvirtuous one between 2004 and 2006.

After the financial crisis we can observe that in 2008 the US started to undertake a virtuous path. However, in the UK the virtuous path started after a little adjustment around 2011. The UK regulatory bodies had already responded to address the unvirtuous path in 2008 but perhaps they did not realize the scale of the problem and the unvirtuous cycle returned to some extent in 2009 and 2010. When the problem became very apparent in Europe, the UK regulatory bodies addressed the issue of the unvirtuous cycle with more persistence. On the contrary, for the Euro area the VUC index shows a marked jump between 2009 and 2012 in the direction of the unvirtuous cycle, reaching a turning point between 2012 and 2013. Why does this significant jump happen after the main financial crisis storm of 2007-2009?

The period between 2009 and 2012 coincides with the period of the Eurozone debt crisis. What is captured by the index is the distortion produced by the disclosed European sovereign debt crisis[32] and ECB bail-out program. As Mario Draghi highlighted in his lecture entitled "Consistent Strategy for a Sustained Recovery" at Sciences Po, Paris, on 25 March 2014, the "Policymakers (after the financial crisis exploded) dealt with the immediate situation without simultaneously addressing all its consequences. It was only when this began to change in June 2012 that we returned to the path of recovery".

What seems interesting is that the ECB low effective policy strategy (procyclical rather than countercyclical) and/or too late intervention (Koo, 2014) combined with the fiscal policy of austerity applied to those countries with budget problems, had exacerbated the unvirtuous cycle which had already built up before the financial crisis, rather than restoring the virtuous cycle. Only in 2012, as highlighted by Mario Draghi, did the index start to register a recovery in the direction of restoring the virtuous cycle. This is interesting, as the index is also able to capture the distortion caused by delayed and incorrect policy intervention, which highlights the debated problem existing in the Eurozone concerning the lack of real integration of the region. However, given the gap with respect to the UK and US, is easy to understand how the Eurozone needs more time now (with respect to 2009) to restore the virtuous path.

The difference in the speed of the recovery between the regional areas under study could also be explained by the delay in implementing a Quantitative Easing program. Since the post-crisis, the Federal Reserve and the Bank of England have respectively activated three (in the US) and two (in the UK) rounds of QE, while only in January 2015 did the European Central Bank announce an expanded asset purchase programme.

According to Koo (2014), at the bottom of the financial solvency crisis of all the three countries/areas discussed here exists a balance sheet problem which has led the economic system to experience what Koo labels a "Balance Sheet Recession". In addition, he is right when he asserts that some countries, such as those in the Euro area, continue to face problems with incorrect policy tools. However, Koo (2014, p. 52) highlights that the structural policy is of an "entirely different nature" to the balance-sheet issues. We do not believe that there is a separation between structural policy and balance sheet policy, given that the balance sheet of the economy mirrors the structure of the entire system and its organization. It is certain that making policy interventions following a "balance sheet approach" (Raberto et al., 2012) and making economic and financial analysis based on it would be better practice to face the emerging bubbles around the system with correct treatment and in a timely fashion.

Finally, the index could be seen as a "watch dog" of the balance-sheet status of the relationship between finance and growth, showing if the system is increasingly unbalanced or remains balanced (or is restoring the balance sheet equilibrium) in terms of assets and liabilities. Following this idea, the approach of scholars, analysts and policymakers should change in order for them to keep up to date with the balance-account equilibrium of the economic system and its agents rather than the "steady-state equilibrium" (Solow, 1956).

5 Policy Implications and Conclusions

Studies of the 2007 credit crash and the resulting recession have revealed how overconfidence in the neoclassical self-adjusting ability of the financial system has led economists and policymakers to underestimate the economic consequences of over-indebtedness and of a speculative multi-leveraging operativity within the financial sector. However, it is interesting to observe that, even though in the literature there is a wide debate on and relevant evidence of the non-neutral and non-exogenous role of the financial system within the economy,[33] the leading monetary policy analysis approach is still founded on the general equilibrium models (based on the General Equilibrium Theory - (Walras, 1877) and the resulting complex models developed, such as DSGE (Dynamic Stochastic General Equilibrium - today widely used by monetary authorities and governments to decide policy strategies and actions). The General Equilibrium models are built on the concept of the neutrality of the role of money within the economic system. Following this assumption, bank money facilitates the economic transactions of the productive sector, but it does not have any relevant role in terms of affecting the structure of the economy and its equilibrium. The mainstream approach has dominated and still dominates the scientific environment and policymakers' general approach. Moreover, the recent policies applied after the financial crisis to recover financial and economic stability have demonstrated that they are unable to identify and resolve the structural factor which caused the 2007-2009 crisis.

The monetary policy actions applied has been focused on low interest rates and procyclical liquidity policies. The last resort monetary policy strategy, to use a quantitative easing program, activated by different central banks around the world, has also mitigated some of the adverse effects of the crisis, but has not resolved those structural problems at the bottom of the finance-growth relationship and which are generating the shift to the unvirtuous cycle. Moreover, some reforms have been introduced with the aim of reformulating the capital rules, shrinking the capital requirements for banks and introducing a monitoring mechanism (macroprudential tools). Very little attention has been paid to the structural reforms of the financial system's interconnections and business. Furthermore, there has been insufficient recognition of the role of financial innovation in accentuating financial imbalances and the consequences for the real economy (macro-imbalances). According to Turner (2010), regulation and supervision should be used to manage what we stress here as the newly established *finance-growth paradigm* as a reverse relationship of the better known "growth-finance linkage" in the literature (see Levine (1997) for an excellent explanation of the traditional growth-finance relationship). The tools currently being adopted are able to partially help the short-term recovery of the economic and financial system, but they are not a good means for a long-run resolution, leaving the economy under the risk of sooner or later facing a new crisis. However, scholars and policymakers will have an insufficient understanding of the long-run growth dynamics until they understand the evolution and functioning of the financial system (Levine, 1997). The main failure of the policies in recovering the economy adequately and restoring a reasonable level of resilience of the finance-growth interdependence against new crises has been due to the following causes:

1. The establishment of the multi-leverage mechanism present within the financial system which triggered what we call a *multi-multiplier effect*, namely the ability of financial agents to split the financial supply chain into more levels of activity, applying at each level a leverage and greatly increasing the quantity of money created endogenously in the economic system.

2. The creation of regulatory black holes owing to highly interconnected and complex financial structures.
3. The role of financial innovation in fostering the development of a highly technological financial system characterized by complex and unintelligible instruments and products and unrecognizable from its original banking-business purposes (the passage from the OTH to OTD financial structure model, see subsection 2.1).

Thanks to the investigated relationship between finance and growth and the empirical evidence of the cross-country analysis conducted, a mix of monetary, macroprudential and structural policies is recommended. The research conducted in this paper shows the existence of what we call the virtuous and unvirtuous cycles and introduces the concept of the *wealth trap* (see section 2). The VUC dynamics are characterized by non-linear causality interactions which are influenced by the different levels of *degree of financial innovation* at any time and by the structural leveraging subdivisions (the OTD model, Originate-To-Distribute) among the agents who are involved in the financial system. In this crucial historical moment, it is particularly important that macroprudential and structural proposals are developed carefully to bring the economy back to the virtuous cycle and create a certain level of financial stability based on "social utility", which should avoid the virtuous cycle from becoming a bad one again. The developed VUC Index should be combined with the credit-to-GDP index in order to set effective macroprudential policy which[1] embodies the new finance-growth paradigm established.

The development of a mathematical toolkit based on the assumptions advanced in this paper would be the main challenge to pursue in future research in order to meet the urgent need to fill the existing gap in the literature with regard to the finance-growth relationship. Some policy analysis of the VUC index and its possible extensions using Agent-Based Modelling methodology (given the constraints of data available) would also be an interesting future development of the present study.

In conclusion, the policymakers' decisions and the policy scholars' efforts should consider human and social economic progress as a whole, in which any form of innovation, including financial innovation, becomes a powerful tool to help society achieve strong qualitative development in all sectors of life. The financial and the economic systems should be at the service of all society. If considering real development of society as a whole, the financial and economic systems should be based on the principle of "being" rather than "having". The shift from public to private self-seeking interests has also created a sociological and ethical problem, highlighting that the system has developed in a remarkably technological way, but it is unbalanced when covering real social needs. Therefore, the new generation of modelling economy should focus on the identification of the real causes of growth and clarify whether there is a deep difference in economics meaning between sociological and technological definitions of the financial system.

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1 The word sociological is used to mean whether the financial system is or is not developed in terms of being socially oriented.

2 The word technological is used to indicate whether the economic system only has a technologically advanced financial system, which, instead of being socially oriented, is more oriented towards the protection of private self-gain interests.

3 With studies based on the analysis of how economic growth promotes or affects financial system development. From this perspective, finance does not determine economic growth. However, growth has a central role in determining finance supply. Broadly speaking, this branch of literature stresses the concept that finance development is a function of economic growth, overlooking the inverse relationship.

4 Pioneer scholars such as Schumpeter (1934), McKinnon (1973) and Gurley and Shaw (1955) took an alternative approach to studying the role of finance in economic growth. This branch of literature is focused on understanding the mechanisms of the impact of finance on economic growth. The approach does not dismiss the growth-finance relationship, but uses it as a starting point to investigate the other direction of the relationship.

5 Mullineux (1990, Ch. 4, pp 105-134) links Schumpeter's and Shackle's work on 'swarms' or 'waves' of innovation and banks' willingness to finance them.

6 According to Shackle (1969), in the financial markets there is speculation over the interest rate. The financial market is permanently volatile and never reaches an equilibrium position. It is an intrinsically unstable variable. Therefore, money and uncertainty are tightly linked and Shackle calls uncertainty "psychological potential surprise". In this respect, he points out that: "…One effect of an event which causes surprise will be to heighten at first the attractiveness of liquidity, that is, of deferment of choice of a specific blueprint, and discourage the immediate construction of equipment. If a large number of investors are thus affected by the same event, the aggregate investment-flow in some period closely following this event will be lower than it would otherwise have been." (Shackle, 1949, p. 75)

7 ...and in some way between them.

8 The wealth trap is generated when a larger and larger portion of the wealth created by the financial system is systematically captured by the financial operators over time and is not channelled into the productive sector. As a result, the captured financial resources are diverted into speculative activities and other financial activities with higher profit returns. The introduction of this behavioural concept is at the basis of understanding where the risk of falling into the "liquidity trap" comes from. See subsection 2.2 for an extended explanation.

9 The word 'greedy' highlights the non-social orientation of the financial system, which is opposed to the reasons why it was established.

10 See footnote 7 for a brief definition of the wealth trap or see subsection 2.2 for an extended explanation.

11 Financial market abuse is the starting point of the unvirtuous cycle (see figure 1).

12 ... as also part of the literature has highlighted (Koo, 2014).

13 See Chaudhry et al. (2015) for discussion on the need for regulation and its comparison with revenue-based regulation, i.e. taxation.

14 This phenomenon does not happen necessarily in all the cycles. There are cycles where asset price inflation and bubbles do not turn into a crisis.

15 The term too-big-to-fail is considered to have been first used during the bailout of the Continental Illinois Bank in 1983, when bank regulators were afraid that the failure of the bank might cause a systematic crisis.

16 The Originate-To-Hold (OTH) model was the original financial system model based mainly on traditional bank business - collecting savings to make loans.

17 The Originate-To-Distribute (OTD) model is the newly established financial system architecture. The OTD model makes it possible to split some activities in the value chain of mortgage and loan supply. Each financial agent can transfer the risk forward to other financial agents along the value chain.

18 In fact, there are papers, in particular empirical ones, which focus on financial intermediation and test for non-linearities in the finance-growth relationship (Arcand et al., 2012; Cecchetti and Kharrouby, 2015), although they do not pay attention to the size concept (Beck et al., 2013).

19 Here, it is important to distinguish between the concepts of "invention" and "innovation". Invention is the ability to create new processes or machinery/tools in order to improve efficiency and profitability and reduce costs. Innovation is the decisional process about how to put an invention into practice (Kane, 1981). In our case, invention is represented by the securitization process. The innovations are implemented by the R&D sector, which acts as a complex, interactive and highly technologically advanced business decision maker within the financial industry.

20 Speculative innovation may be driven by bank size.

21 Commercial banks are at the base of the securitization process. Usually, they are the first financial actors to start the process within the financial system, but not in an exclusive way.

22 Richard Koo (2014) has coined the term *balance-sheet recession*. It occurs when high levels of indebtedness cause consumers and/or companies to save to repay their debts rather than spending or investing, slowing economic growth or causing a recession.

23 A wide branch of literature is totally absorbed by the attempt to identify best Early Warning Models able to provide warning signals early enough to allow policymakers to act on the trend in time, preventing (or avoiding) the costly events for the economic system such as banking crises.

24 The event and the emerging variables which have provoked the event are completely new; there are no data about them.

25 Indeed, this concept is unrealistic, given the approximation of error that is typically applied to data analyses.

26 Historical analysis is often used by evolutionary scholars to develop heuristic patterns that can be used to describe and categorize these developments in a more general way.

27 The institutional environment is important because it is a facilitator of and an impediment to technological change and, consequently, to economic growth. The economic system is tightly linked to the changing institutional structure of financial markets, increasing complexity due to financial innovation and shadow banking activities and the role played by the central authorities (politics and policy) in determining financial market development.

28 Recently, only the European Central Bank, for the Euro area, started to gather these kinds of data from the SPV/SPE – Special Purpose Vehicle/Entity (and strangely not from each bank). The data are available from 2012 annually and only from 2014 are they quarterly. The data are available on the ECB website – see the statistics section.

29 Historically, the evolution of derivatives and modern financial innovation started in the 1970s. It is possible to distinguish three periods:

1. 1972 to 1982 was characterized by the development and diffusion of futures not based on commodities but on mortgages, currency, interest rates, treasury bills, T-bonds, Eurodollars and the stock index.
2. 1983 to 1993 was characterized by the development and diffusion of options based on the Black-Scholes model, swaps and over-the-counter derivatives.
3. 1993 to now has been characterized by the development and diffusion of credit derivatives (funded and unfunded).

Moreover, in the 70s the Negotiable Order of Withdrawal or super account (NOW) was introduced, and in 1978 checkable deposits, accounts with automatic transfer from interest-paying saving accounts (ATS) thanks at the introduction of the electronic payment system. The proxy used in this paper is related to the third period. The time series in the first and the second period are very fragmented and not available for all countries in order to make a meaningful cross-country comparison. Filling the gap in the data needs to be considered in the future by scholars (in particular econometricians and statisticians) because it is important to investigate the historical conditions that led to the economic system reversing the pre-existing balanced relationship between growth and finance.

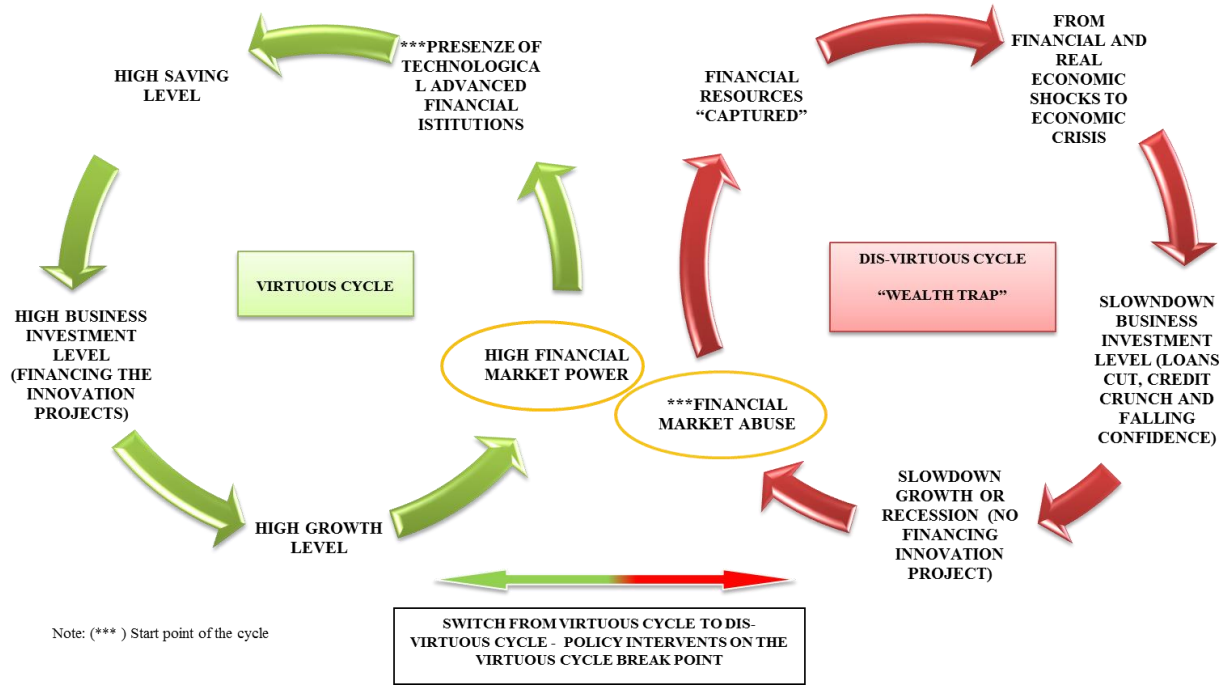
30 In figures 4 to 15, Trd represents trading derivatives and CD represents credit derivatives.

31 The suffix ‘fi’ represents the fixed-based index and ‘ci’ represents chain-based index in figures 4 to 15.

32 In fact, since 2009 the effect of the 2007-2008 financial crisis has started to unveil the critical debt condition of the Eurozone members, who, since 1992, had been authorized to securitize future government revenues in order to reach and maintain the Maastricht criteria. This helped to exaggerate the governments’ balance-sheets, masking their real debts and deficit conditions.

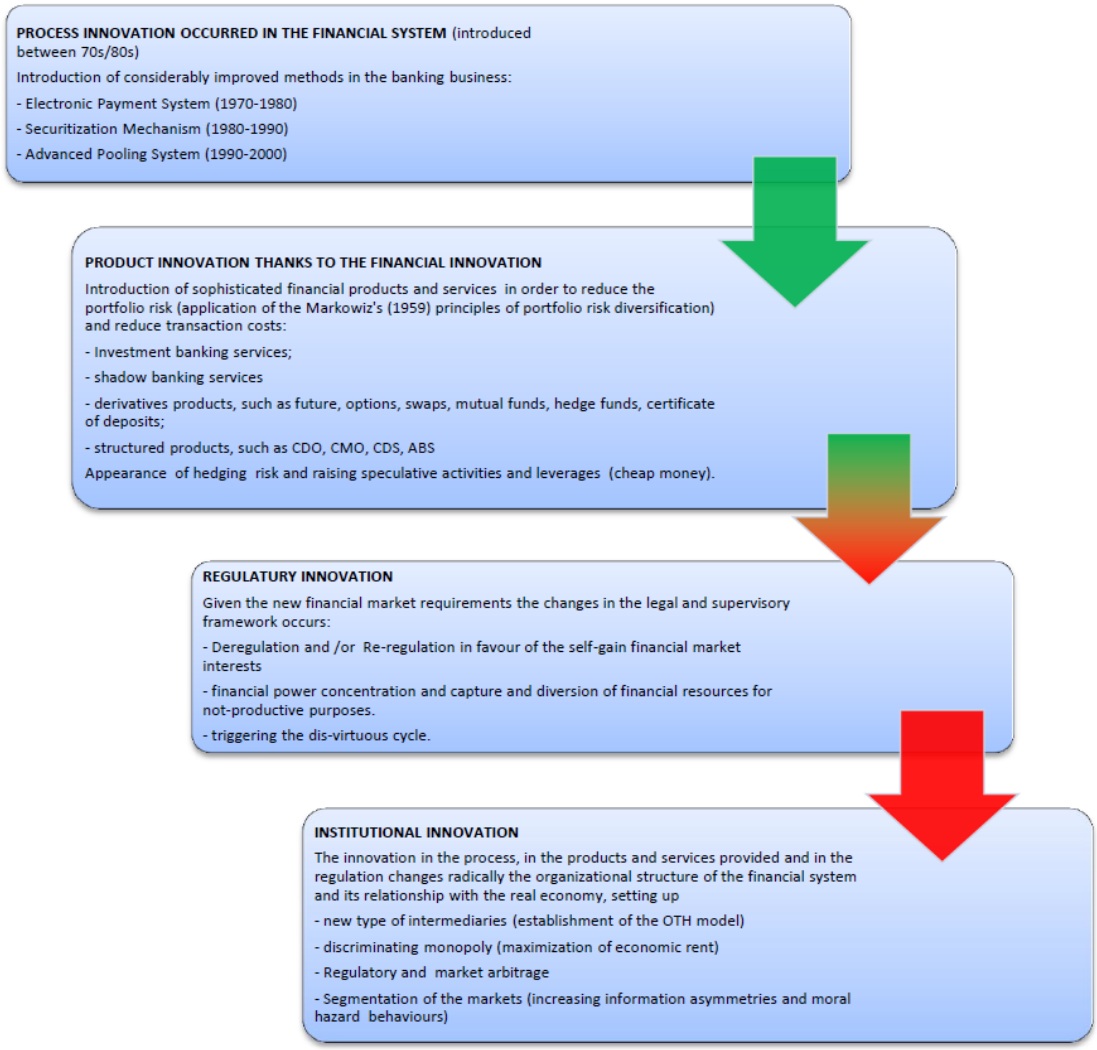
33 The pre-Keynesian business literature (see Hansen and Littauer, 1951; Haberler, 1958) for an excellent review) had already argued the possibility that the financial system might be a source of instability, leading to crises. One of the leading exponents of the post-Keynesian branch, Minsky (1986), argued that capitalism is unstable and the financial structure of the capitalist economy becomes more and more fragile during periods of economic prosperity.

FIGURES LIST



Source: Lauretta (2014) elaboration

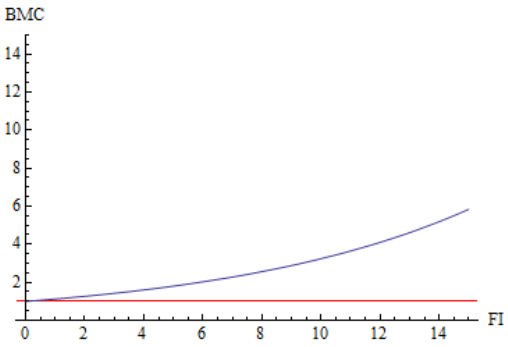
FIGURE 2: Schematic representation of the development of financial power concentration and the establishment of the unvirtuous cycle.



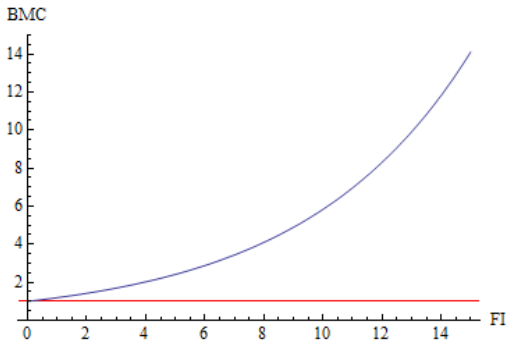
Source: Authors' elaboration

FIGURE 3: Representation of the dynamics of the securitization ratio variation and its impact on endogenous money/credit creation over time. For the exercise, the hypothetical securitization ratios

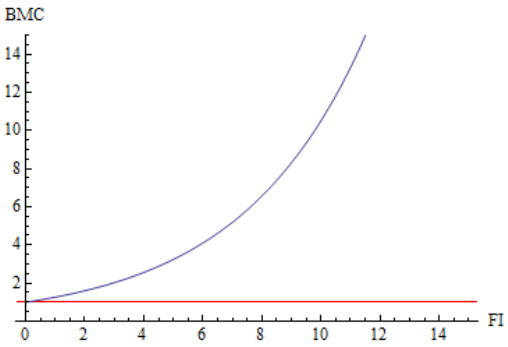
applied are t_0=10%, t_1=15%, t_2=20%, t_3=25%, t_4=30%, t_5=35% and t_6=40%. The x-axis shows financial innovation (*FI*) and the y-axis shows bank money creation (*BMC*). The red line represents the Monetary Base assumed variable over time but, for the sake of clarity, it is constant in each period. The variation in the function incorporates the degree of financial innovation effect.



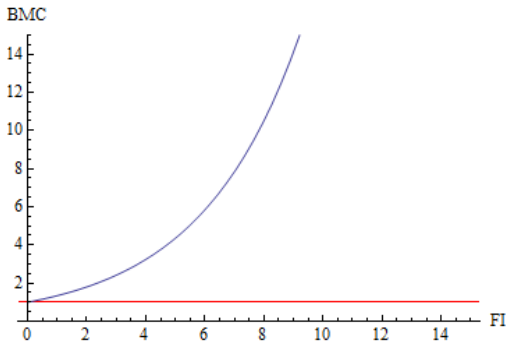
(t_0)



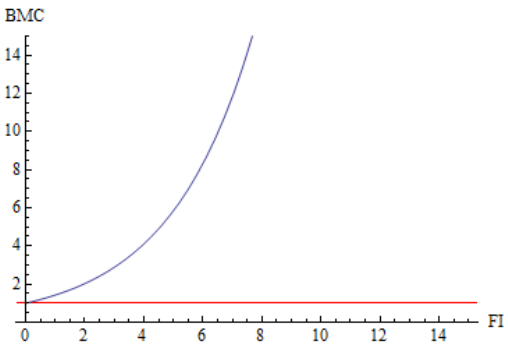
(t_1)

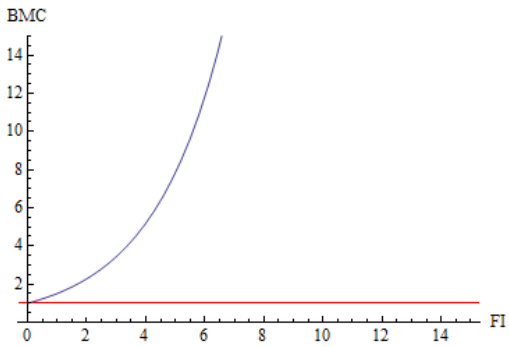


(t_2)

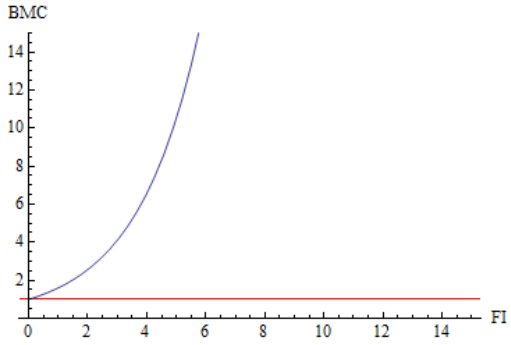


(t_3)





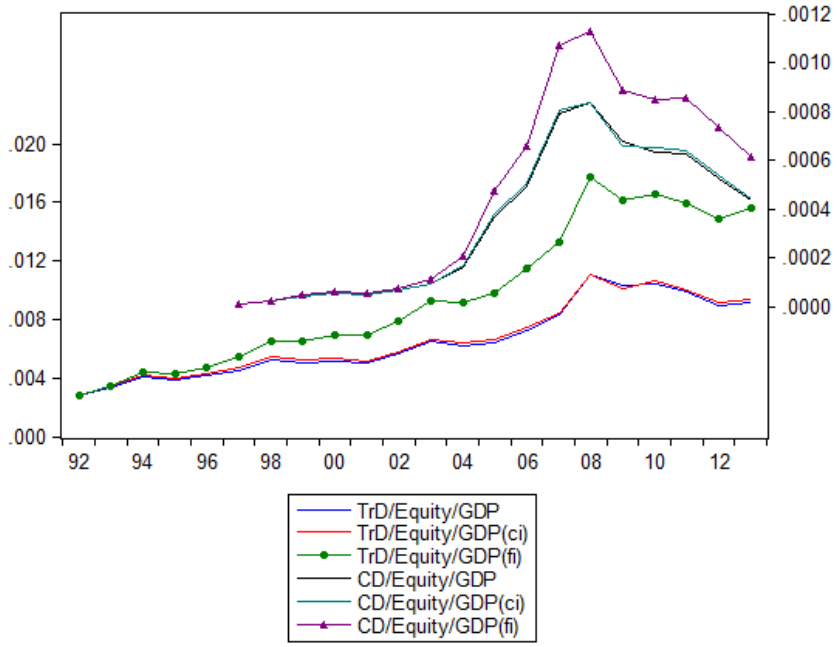
(t_4) (t_5)



(t_6)

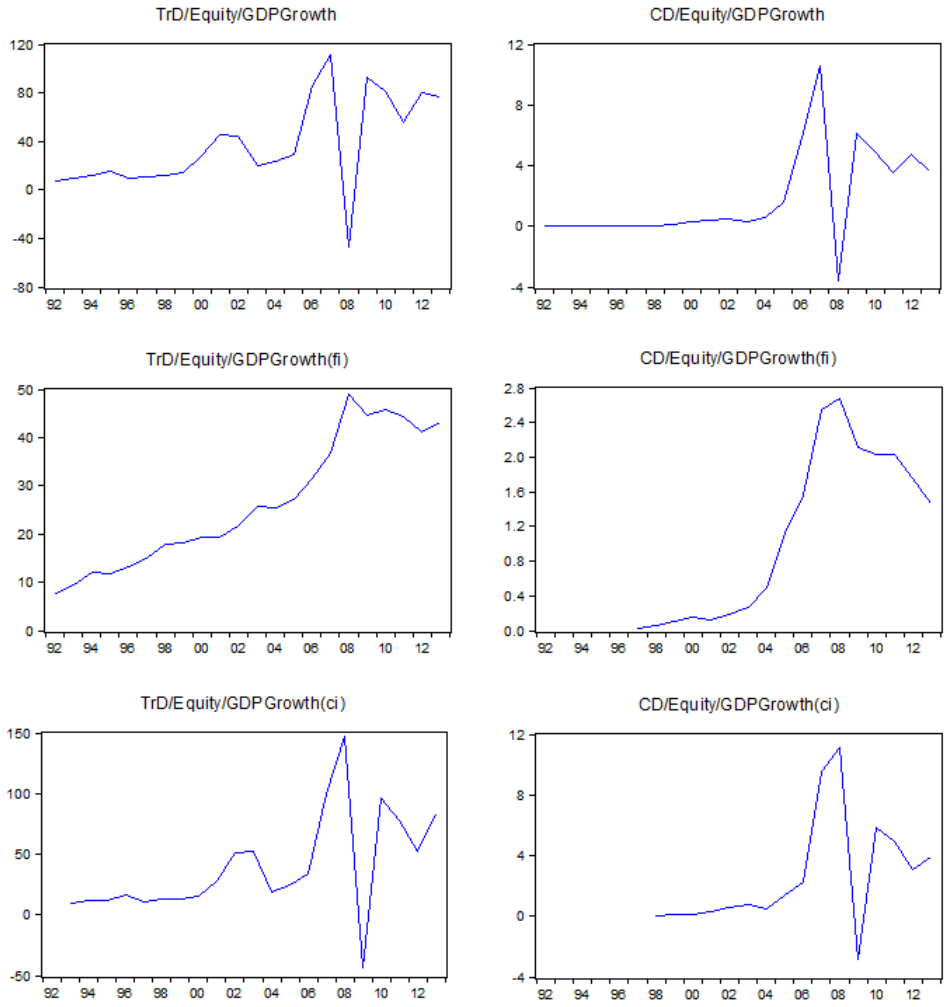
Source: Authors' elaboration.

FIGURE 4: VUC Index for the US



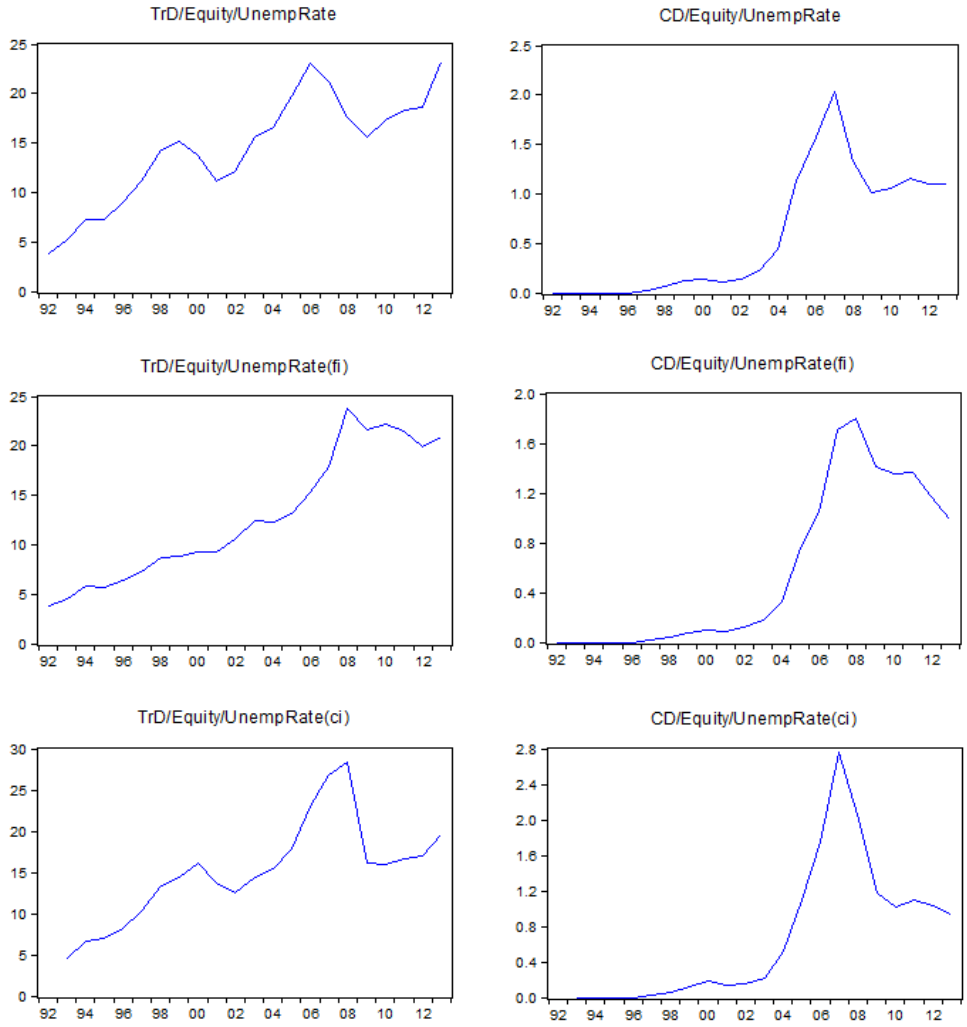
Source: Authors' elaboration

FIGURE 5: VUC Index for the US with GDP growth as denominator



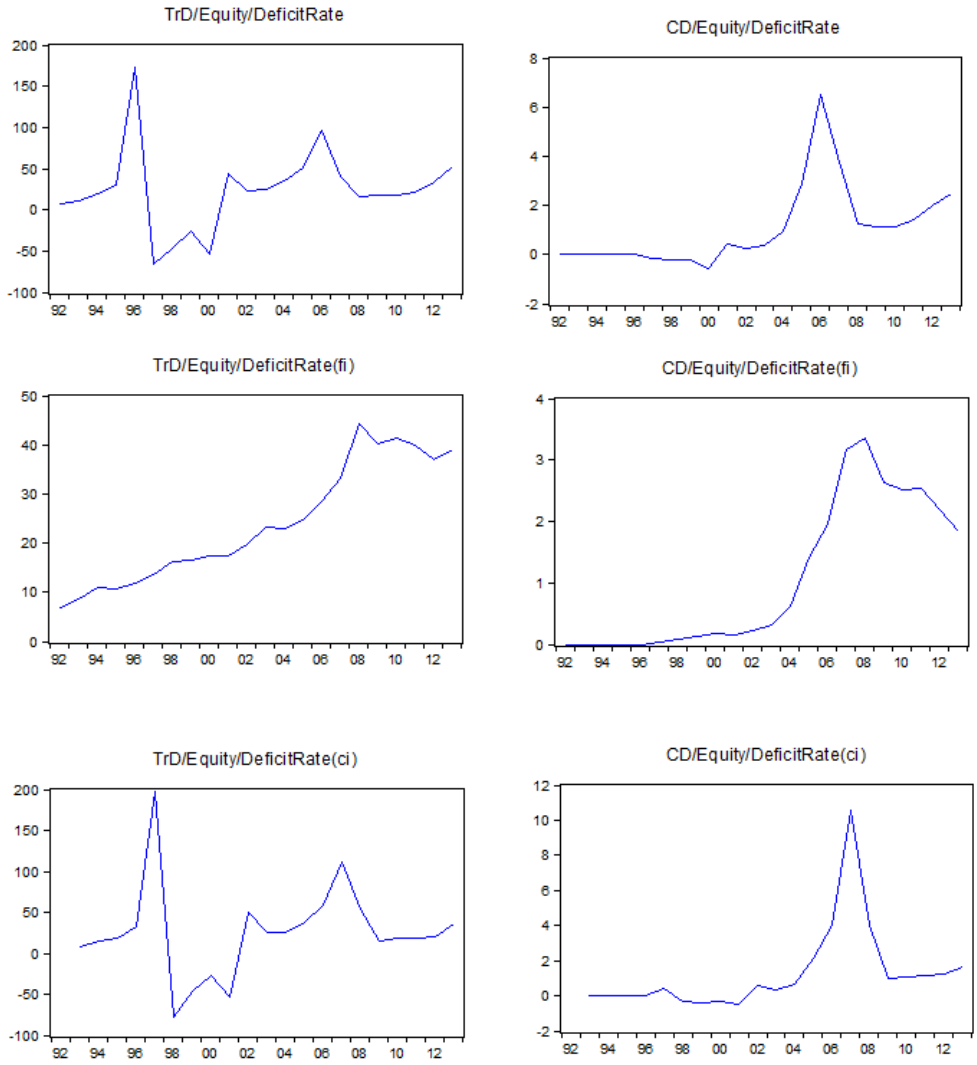
Source: Authors' elaboration

FIGURE 6: VUC Index for the US with Unemployment as denominator



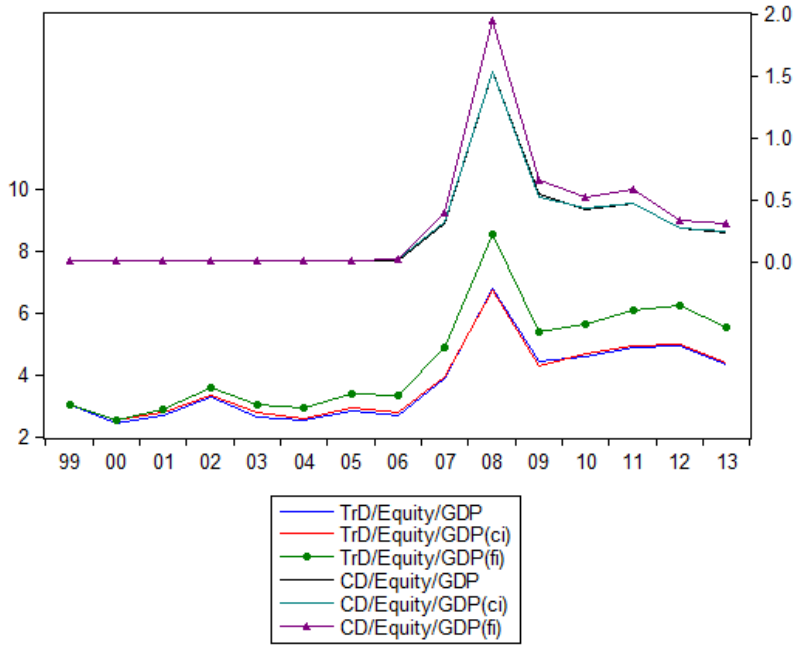
Source: Authors' elaboration

FIGURE 7: VUC Index for the US with Government Deficit as denominator



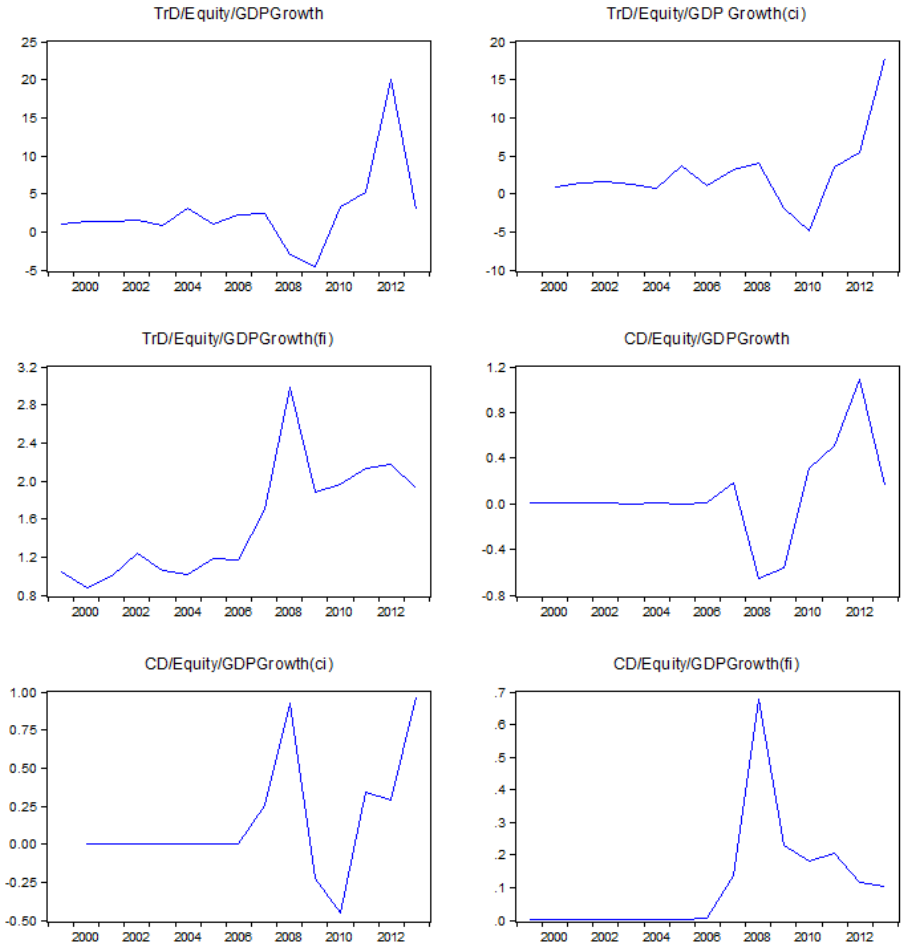
Source: Authors' elaboration

FIGURE 8: VUC Index for the UK



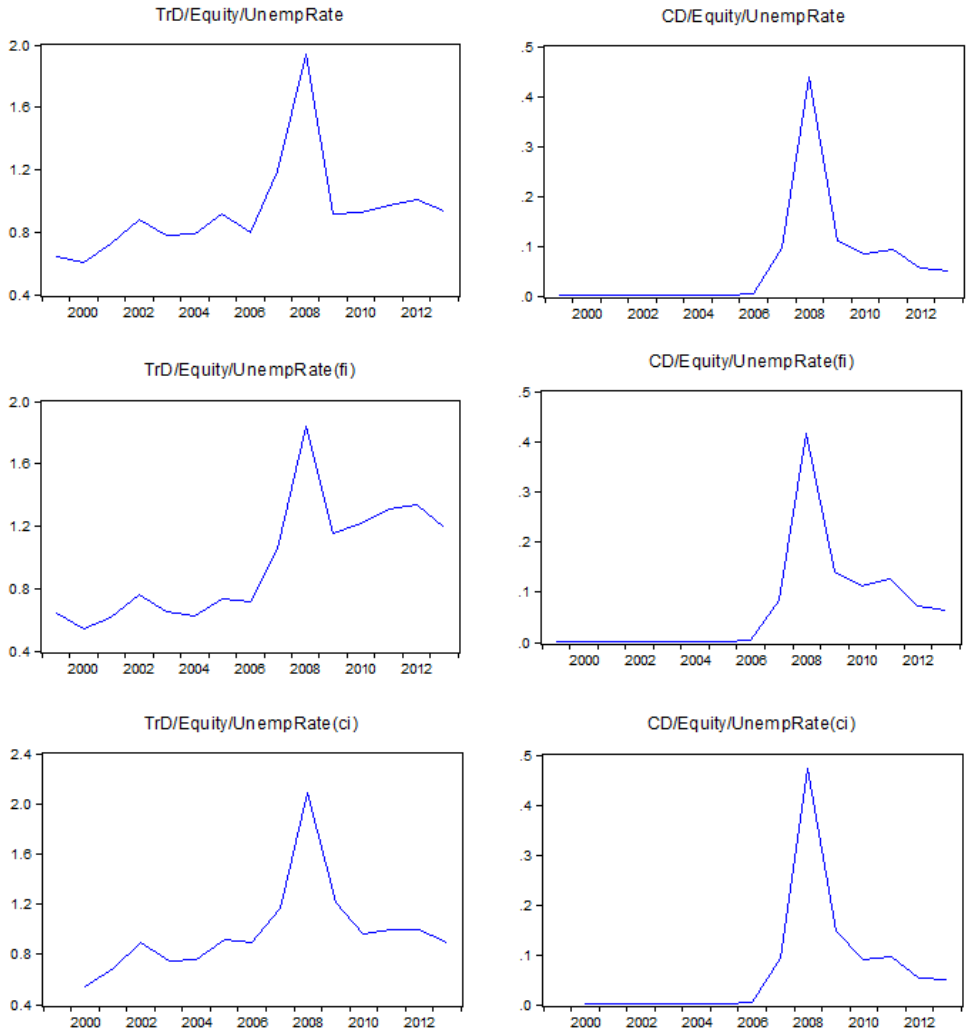
Source: Authors' elaboration

FIGURE 9: VUC Index for the UK with GDP growth as denominator



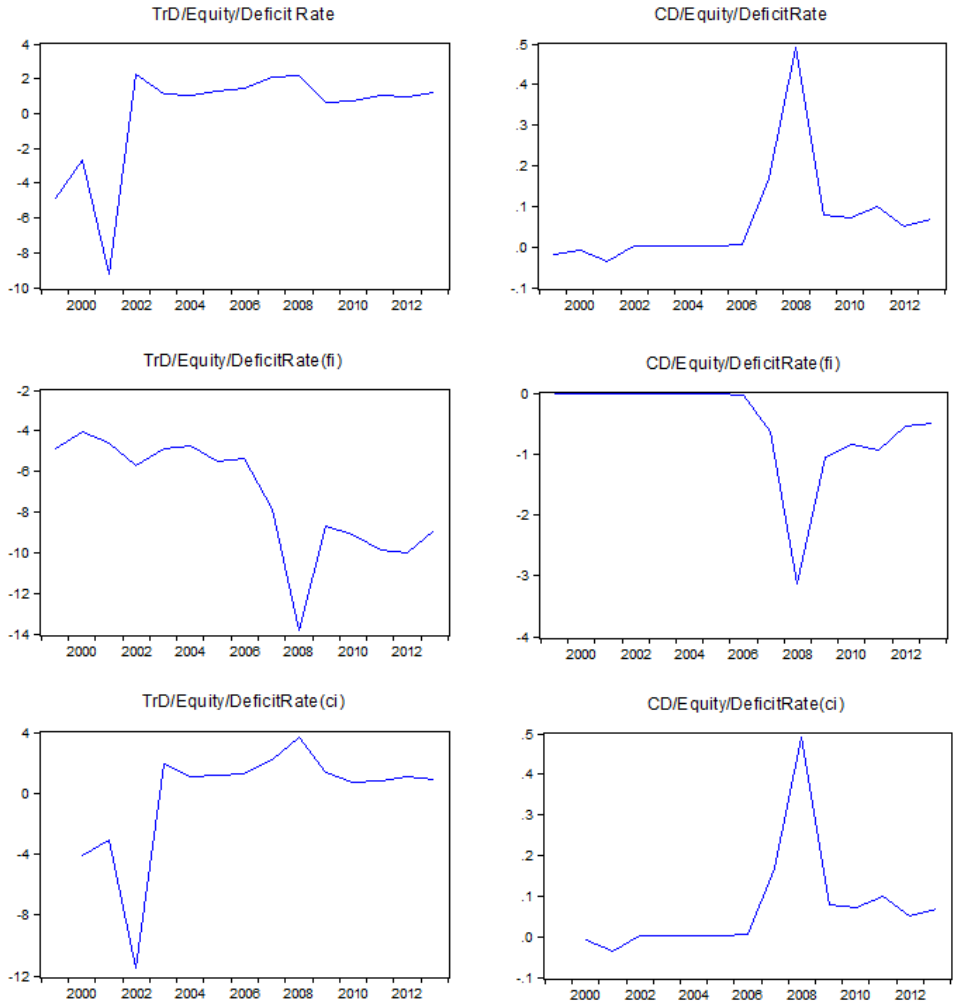
Source: Authors' elaboration

FIGURE 10: VUC Index for the UK with Unemployment as denominator



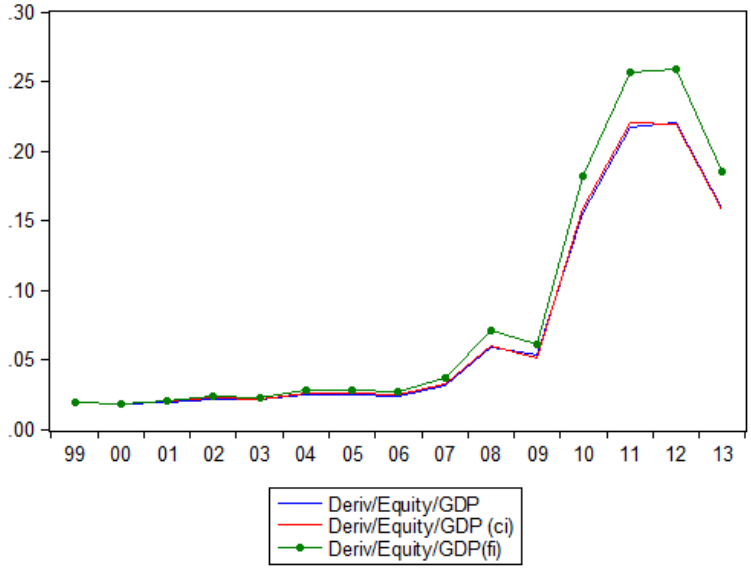
Source: Authors' elaboration

FIGURE 11: VUC Index for the UK with Government Deficit as denominator



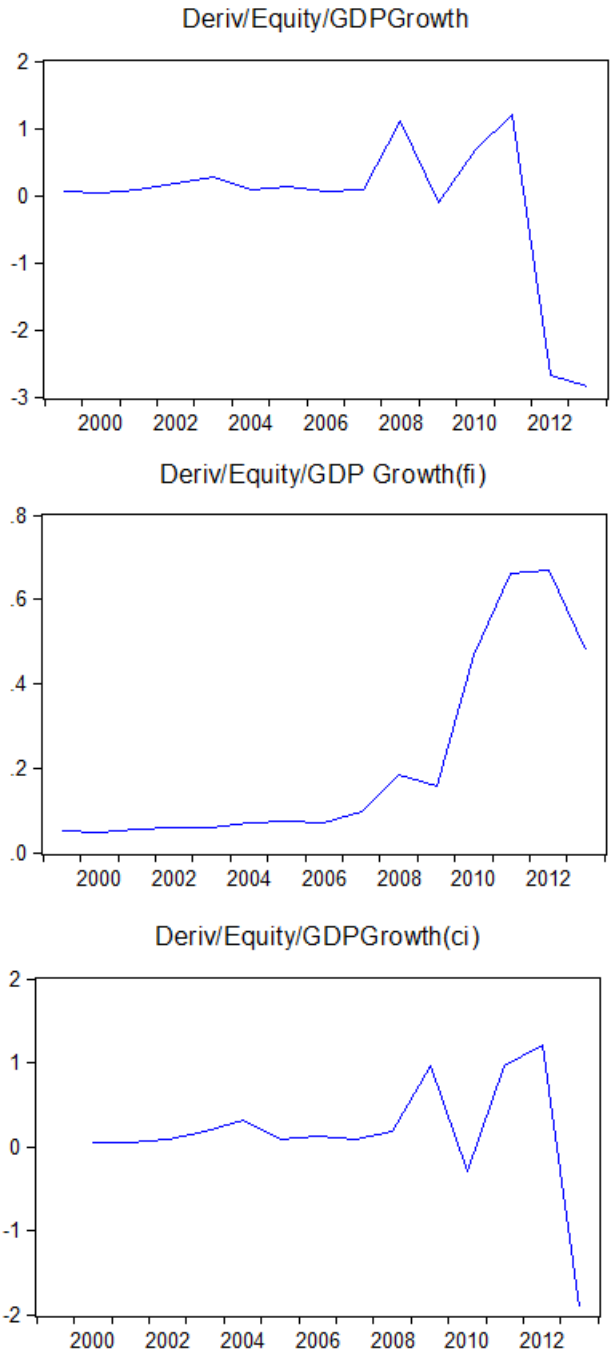
Source: Authors' elaboration

FIGURE 12: VUC Index for the Euro area



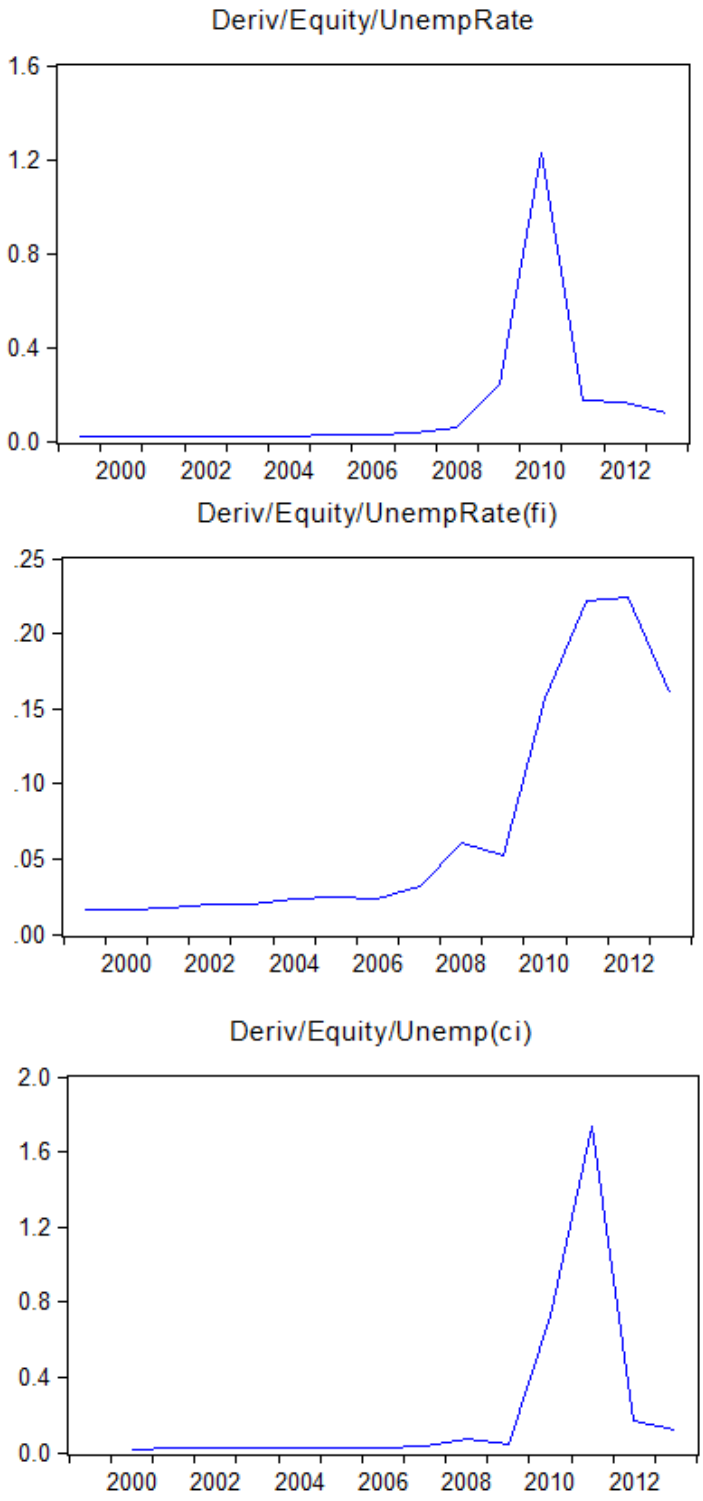
Source: Authors' elaboration

FIGURE 13: VUC Index for the Euro area with GDP growth as denominator



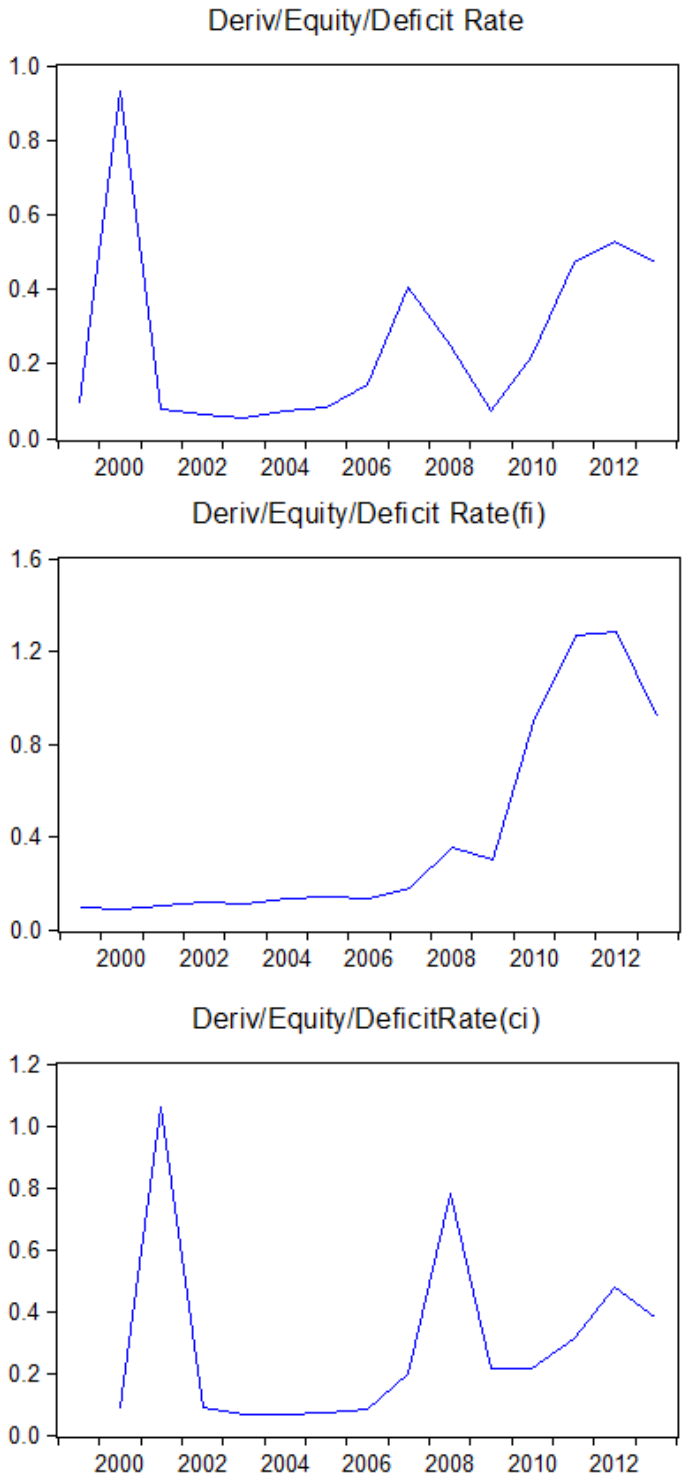
Source: Authors' elaboration

FIGURE 14: VUC Index for the Euro area with Unemployment as denominator



Source: Authors' elaboration

FIGURE 15: VUC Index for the Euro area with Government Deficit as denominator



Source: Authors' elaboration